GPS TO MONITOR THE BRT BUS

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Abstract: - A typical application of ITS (Intelligent Transportation System) is the location of vehicles on the road infrastructure as from the location you can get various information associated, such as average speed, set to the target time, congestion, among others. So the location of the bus in the corridors of BRT (Bus Rapid Transit) are very important and help to improve the quality of services (QoS) provided by the urban public transport. This article presents one of the technologies used to make the bus location, which is the GPS (Global Positioning System) is a system that identifies the position of the bus through the use of global positioning satellites.

Key-Words: - GPS, LBS, ITS, BRT, QoS

1 Introduction

The Brazilian urbanization process and the formation of large cities, introducing a growing complexity for the planning, management and operation of urban mobility. Meet the expectations of quality, safety and comfort for the displacement of people and the search results are compatible with the sustainability requirements for the public transport sector, put requirements that can only be achieved by the increase of technology and intelligence. [2]

The complexity of urban planning, the lack of intelligent solutions and measures to encourage car purchases bring a constant problem in large cities: traffic. Big cities no longer support the excess vehicles and already find themselves in total chaos. An example is the city of São Paulo, which in February 2011, spawned 1,184 new cars a day, a 9% higher than the same period in 2010. It is estimated that, of these, 3 8 million circulate daily by more than 17,000 kilometers of capital roads. While the São Paulo population has grown 32% since 1980, the number of fleet vehicles more than quadrupled. [1]

The traffic problem in cities makes room for different solutions. The goal is to improve system capacity and quality of service provided to citizens, helping to relieve the traffic in the metropolitan area. Solutions such as the subway, the bus lane and trains, make the citizen arrives faster to their final destination and stop using the personal automobile as a means of locomotion.

The ITS also brought a new ally to traffic chaos, the concept of intelligent traffic being trend in big cities and reflects in many benefits such as increased quality and planning in urban mobility and consecutively increasing the quality of life of citizens. Having a smart and able to arouse the interest of the user public transportation will be critical for the planning of large cities.

2 Project Objective

The aim of this article is to evaluate the GPS as a technology for LBS (Location Based Service) that is a specific platform that works to localize the bus at road infrastructure, mainly at BRT corridor.

3 ITS Technologies

Daily activities like going to work, to school or to the market are only possible with the mobility of the individual to a point A to point B. Thinking these simple situations, realize the importance and the impact of transport on society. The term transport can be assigned to the movement of people or products. The transport of persons is called passenger transport and transport of products can be termed as cargo transportation. Urban transport is used to describe the movement of people and products made in the inner cities. This is due to various reasons of everyday life such as work and studies. Urban transport of loads is also common due to various reasons such as collecting garbage and transport of inputs of an industry.

The means of transport is also characterized with respect to their property. The cities have become highly dependent on urban public transport. This type of service has become central to the planning of urban mobility to the point that has also become an extremely sensitive issue.

The Public Transportation System Passenger (PT) has been undergoing changes due to new technologies and market changes as well as social changes. Over the past decade the public transport suffered a reduction in passenger demand, starting to suffer from the competition of individual transport.

The lack of attractive and the high cost of urban public transport contribute to citizens opt for the use of individual transport. The increase of population in large cities aggravates the displacement problem. It is estimated that in 2050 approximately 70% of the world population will live in urban areas. These data generate a great challenge related to infrastructure of cities and requires strategic planning of urban public transport.

Modernize urban public transport and increase the quality of services is an attractive option for citizens. These items that contribute most to the improvement in the service quality of public transport are related to infrastructure and technology used in vehicles. Thus, the use of ITS becomes crucial for urban public transport.

The ITS is technologies evolving the common problems of public transport. Among them fall into the multimodal control centers and operations, advanced systems traffic signaling, monitoring systems and monitoring, parking management, management incidents of traffic, emergency response, electronic payment, dynamic pricing and user information in real time.

The automatic vehicle location or Automatic Vehicle Location (AVL) consists of subsystems that allow locate the vehicle during its path in real time. These subsystems are made up of several devices

It is embedded to enable the geographical location of the vehicle and sending information. The most common use of AVL is the Global Positioning System (GPS), but can be used with other positioning technologies as radio frequency and mobile phone network.

AVL systems collect the geographical positioning information for a subsystem of data acquisition and using a communication subsystem, sends the data to a central information and control, which is the information processed with specialized software and data integration positioning with the existing database and information management tools. The management of all information of location data and vehicle status is achieved by systems of Information Management.

The AVL system through GPS or radio frequency obtains the location of the vehicle and by sending these data to the user processing system can obtain the location of the vehicle. See figure 1.

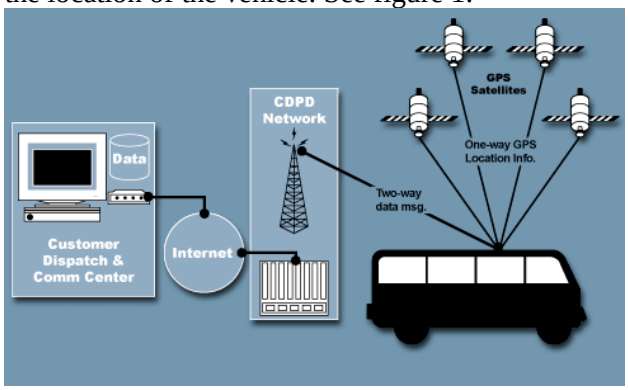

Fig.1: AVL System (Source: ThomTechDesign)

The AVL system collects several information from the bus, as presented on Figure 2.

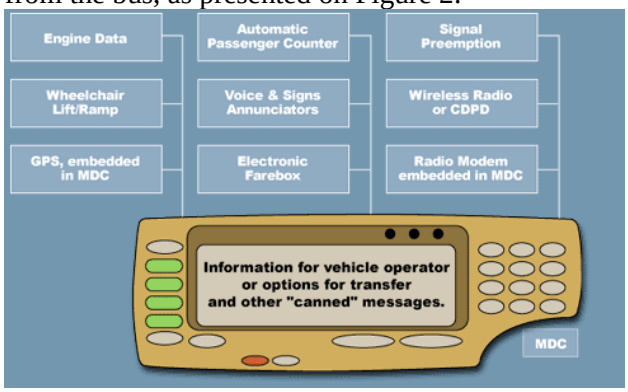

Fig.2: AVL (Source: ThomTechDesign)

AVL products are typically configured with update rates that are between 1-15 minutes. This rate is chosen to obtain a good margin of cost and benefit for applications that need this type of service. The choice of update rate directly affects the cost of

implementing, since the greater the number of updates higher financial costs. [3].

3 Positioning System

The positioning systems used in AVL systems in four technologies: dead-reckoning (DR), fixed stations, radio aerial triangulation and positioning satellites.

Systems able to detect positions of certain objects or individuals in the earth's surface are known as geodetic positioning systems or Global Navigation Satellite Systems (GNSS). Among the GNSS the best known are the Navigation System Using Time and Ranging Global Positioning System (NAVSTAR-GPS), of American origin, the Global Navigation Satellite System (GLONASS), of Russian origin, and Galileo, of European origin.

The GPS was developed by the Department of Defense of the United States of America. It was originally devised for military applications, and then made available for civilian use.

The GPS system design allows the user, at any time, to track at least 4 satellites anywhere on the earth's surface that allows the user a real-time location. This operating availability is due to distribution of 24 satellites in earth orbit. See figure 3.

Fig.3: Satellite Distribution

The basic principle for the operation of a GPS system should be measuring the distance between the receiver antenna and the antennas of satellites in the constellation.

From this measurement the distance between the receiver antenna and four satellites simultaneously, one can determine the geographical position (coordinate) of the receiver antenna, Figure 4 shows how this process works.

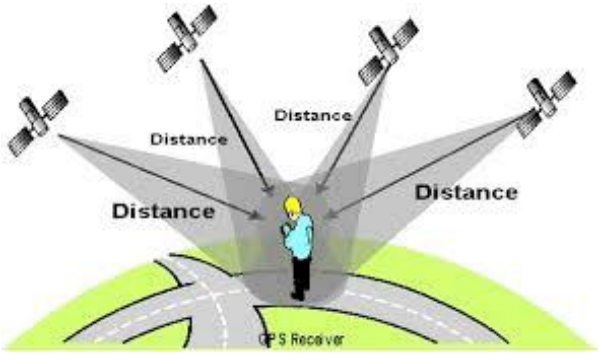

Fig.4: Determination of Positioning

The GPS system is the coordinate based on the World Geodetic System 1984 (WGS84), that consist of three Cartesian axes associated with an ellipsoid so that the coordinates may be presented in terms of Cartesian axes X, Y and Z or latitude, longitude and elevation from ellipsoid.

Latitude or X axis has the coordinate reference to the equator, where above the equator means north and down south means and its measurement is expressed in degrees, ranging from 0 ° to 90 °.

Longitude or Y axis has reference to the Greenwich Meridian and its measurement is expressed in degrees and can range from 0º to 180º. Each degree of longitude is subdivided in 60 minutes, and these 60 seconds. A length is specified in degrees, minutes and seconds.

Calculating the position of a GPS receiver is based on time. It processes information from at least three satellites to obtain the latitude and longitude coordinates, thereby obtaining the position in two dimensions (2D). To obtain the position in three dimensions (3D) is required at least four satellites, thereby obtaining a latitude, longitude and altitude.

There is a time lag between the atomic satellite clock and the internal clock of the receiver. This error is resolved by calculating the distance of four satellites, where the satellite sends a signal called pseudo and at the same time, the GPS receiver begins to generate the same code, the difference between the signal emitted and received is equal to the transit time of the signal. With this information the receiver makes the calculation on the basis the speed of light and executes the following equation, the distance is equal to velocity times time. With data from four satellites the position is determined.

Determine the position of an object using GPS technology may be subject to some problems such as signal interference and noise caused by numerous factors such as environments with many buildings or heavily wooded areas that hinder the visibility of satellites by the receiver.

3 Data Communication

After determining the vehicle location by latitude and longitude and also the date and time of measurement, these data should be sent through via cellular communication channel or wireless network (WiFi).

4 Conclusion

The location of the bus is important in BRT operation it is possible to determine a series of actions from this information. This action can determine: The expected time to arrive at the bus stop; Average speed on the BRT corridor; Problems related to congestion in the corridor; Find the position of each bus and reposition as necessary; Trigger the traffic light system to pass priority at traffic lights; among others.

One point that stands out is that GPS is widely used in other services and is available in most mobile phones, type smartphone, which demonstrates that technology is very robust and works properly.

A typical communication channel is using the cellular network, but the ITS infrastructure enables other forms of communication such as via wireless communication (Wi-Fi), among others.

It can be concluded that the technology is interesting and relevant for the ITS needs.

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